Molecular Toxicology: Chemical and Biological Mechanisms (PHRM 5900) – Spring 2023

Course Director: Trevor M. Penning, Professor of Systems Pharmacology and Translational Therapeutics; Director, Center of Excellence in Environmental Toxicology

Email: penning@upenn.edu

Course Goals: Exposures to foreign compounds (drugs, carcinogens, and pollutants) can disrupt normal cellular processes leading to toxicity. This course will focus on the molecular mechanisms by which environmental exposures lead to end-organ injury and to diseases of environmental etiology (neurodegenerative and lung diseases, and reproduction and endocrine disruption). Students will learn the difficulties in modeling response to low-dose chronic exposures, how these exposures are influenced by metabolism and disposition, and how reactive intermediates alter the function of biomolecules. Mechanisms responsible for cellular damage, aberrant repair, and end-organ injury will be discussed. In addition, students will discuss the relationship between genetics and epigenetics and environmental exposures. Students will learn about modern predictive toxicology to classify toxicants, predict individual susceptibility and response to environmental triggers, and how to develop and validate biomarkers for diseases of environmental etiology. Students are expected to write a term paper on risk assessment on an environmental exposure using available TOXNET information. This course is required for those pursuing the Certificate Program in Environmental Health Sciences.

Format: 60-minute lectures; three times per week on Monday/Wednesday/Friday

Course Materials: Casarett & Doulls: Toxicology: The Basic Science of Poisons (7^{th} – 9^{th} Ed) and relevant literature.

Pre-requisites: Undergraduate course work in biochemistry and chemistry essential. Exceptions allowed based on past course work. Please consult with the Course Director.

Students: All 1st and 2nd year BGS students with required prerequisites; Residents in Environmental and Occupational Health, and Professional Master's Students (e.g. MPH and MTR).

Accommodations for Students with Disabilities: The University of Pennsylvania provides reasonable Accommodations to students with disabilities who have self-identified and received approval from the Office of Student Disabilities Services (SDS). If SDS has approved your request for accommodations, please make an appointment to meet with me as soon as possible in order to discuss the arrangements for your accommodations. If you have not yet contacted Student Disabilities Services, and would like to request accommodations or have questions, you can make an appointment by calling (215) 573-9235. The office is located in the Weingarten Learning Resources Center at Stouffer Commons, 3702 Spruce Street, Suite 300. Please visit the SDS website at http://www.vpul.upenn.edu/lrc/sds/index.php. SDS services are free and confidential.

Molecular Toxicology Course Schedule- IMPORTANT PLEASE READ

Course Times: Mondays, Wednesdays, and Fridays: **1:45PM-2:45PM** and other classes are **1:45PM–3:45PM** as highlighted in gray on the schedule. Please read the schedule carefully; most in-person classes will be held in Smilow 10-146AB or Smilow 10-100 (*on Fridays beginning in February*) Other classes utilize a pre-recording or are live online.

Location: **Smilow 10-146AB**
Smilow 10-100
Live Online
Pre-recorded

2023 Spring Schedule

Week	Date	Location	Topic	Lecturer
General Principles				
1	W, Jan 11	Smilow 10-146AB	Introduction /Orientation	Trevor Penning, PhD
	F, Jan 13	Smilow 10-146AB	General Principles: Dose Response & Exposures	Trevor Penning, PhD
2	M, Jan 16		MLK Day – No Class	
	W, Jan 18	Smilow 10-146AB	Regulatory Policy and EPA	Richard Pepino, MS
	F, Jan 20	Smilow 10-146AB	Reactive Oxygen Species	Harry Ischiropoulos, PhD
3	M, Jan 23	Smilow 10-146AB	Heavy Metal Toxicity	Jay Schneider, PhD
	W, Jan 25	Smilow 10-146AB	Metabolism Phase I	Trevor Penning, PhD
	F, Jan 27	Smilow 10-146AB	Metabolism Phase II	Trevor Penning, PhD
4	M, Jan 30	Smilow 10-146AB	Chemical Carcinogenesis by Genotoxic Agents	Trevor Penning, PhD
	W, Feb 1	Smilow 10-146AB	Chemical Carcinogenesis by Non-Genotoxic	Trevor Penning, PhD
	F, Feb 3 1:45pm-3:45pm	Smilow 10-100	Mutagenesis/Mutational Signatures (1:45-2:45pm) w/Dr. Field Problem Set Metabolism (2:45pm-3:45pm)	Jeffrey Field, PhD
5	M, Feb 6	Smilow 10-146AB	DNA Adducts and their Repair	Trevor Penning, PhD
	W, Feb 8 1:45pm-3:45pm	Smilow 10-146AB	Mitochondrial Dysfunction (1:45-2:45pm) w/Dr. Blair Problem Set Chemical Carcino-genesis (2:45pm-3:45pm)	Ian Blair, PhD Trevor Penning, PhD
Gene-Environment Interactions				
	F, Feb 10 1:45pm-3:45pm	Smilow 10-100	Toxicogenetics – Toxicology and DNA Variation Toxicogenomics – Toxicology and RNA Expression	Ted Burczynski, PhD

Week	Date	Location	Topic	Lecturer
6	M, Feb 13	Smilow 10-146AB Live Online	Transcriptome-Analysis-Technologies and Experimental Design	John Tobias, PhD
	W, Feb 15	Smilow 10-146AB	Epigenetics	Thea Golden, PharmD, PhD
	F, Feb 17	Pre-recorded	Folate and Methylation	Steve Whitehead, PhD
7	M, Feb 20	Smilow 10-146AB	Risk Assessment Assignment	Trevor Penning, PhD
	W, Feb 22	Smilow 10-146AB	Midterm	Proctor: Jeffrey Field, PhD
Exposure Science				
	F, Feb 24	Smilow 10-100	Protein-Biomarkers-Proteomics	Clementina Mesaros, PhD
8	M, Feb 27	Smilow 10-146AB	Exposure and Response Biomarkers	Clementina Mesaros, PhD
	W, Mar 1	Smilow 10-146AB	Biosensors	Charlie Johnson, PhD
	Mar 4-12	Spring Break – No Class		
Organ-Based Toxicology				
Lung and Airway-Disease				
9	M, Mar 13 1:45pm-3:45pm	Smilow 10-146AB	Inhalation Toxicology 1: Respiratory Physiology Inhalation Toxicology 2: Mechanisms of Lung Injury	Krithika Lingappan, MD, PhD, MS, Sharon McGrath-Morrow, MBA, MD
	W, Mar 15	Pre-recorded	Toxic Responses of the Respiratory System	Melpo Christofidou-Solomidou, PhD
	F, Mar 17	Smilow 10-100	Mesothelioma	Trevor Penning, PhD
10	M, Mar 20	Smilow 10-146AB	Lung Cancer	Anil Vachani, MD, MSCE
Nervous System				
	W, Mar 22	Smilow 10-146AB	Overview of the Nervous System and Neurotoxicants	Michael Robinson, PhD
	F, Mar 24	Smilow 10-100	Mechanisms of Neurotoxicity	Harry Ischiropoulos, PhD
11	M, Mar 27	Smilow 10-146AB	Sleep Disturbance and Neurodegenerative Disease	Sigrid Veasey, MD
Reproductive & Endocrine Disruption				
	W, Mar 29	Smilow 10-146AB	In utero Genetic Imprinting	Marisa Bartolomei, PhD
	F, March 31	Pre-recorded	Mechanisms of Reproductive Disruption-Male	George Gerton, PhD
12	M, Apr 3	Smilow 10-146AB	Environmental Reproductive Epidemiology	Aimin Chen, MD, PhD
Data Integration & Predictive Toxicology				
	W, Apr 5	Smilow 10-146AB	Data-Integration-Bioinformatics	Aalim Weljie, PhD
	F, Apr 7	Smilow 10-100	Exposure Biology Informatics	Blanca Himes, PhD

Week	Date	Location	Topic	Lecturer
13	M, Apr 10	Smilow 10-146AB	Predictive Toxicology and TOX 21st Century	Joseph Romano, PhD
	W, Apr 12	Smilow 10-146AB	Risk Assessment Live Presentations	
	F, Apr 14		Final Examination	

Evaluation:
Mid-Term: 30%
Final Exam: 40%
Risk Assessment Paper: 30%
Text: Casarett & Doulls: Toxicology: The Basic Science of Poisons (7th – 9th Ed)

Questions on individual lectures can be sent by email to:

Lecturers:	Email Address
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